ISL Uranium Mining

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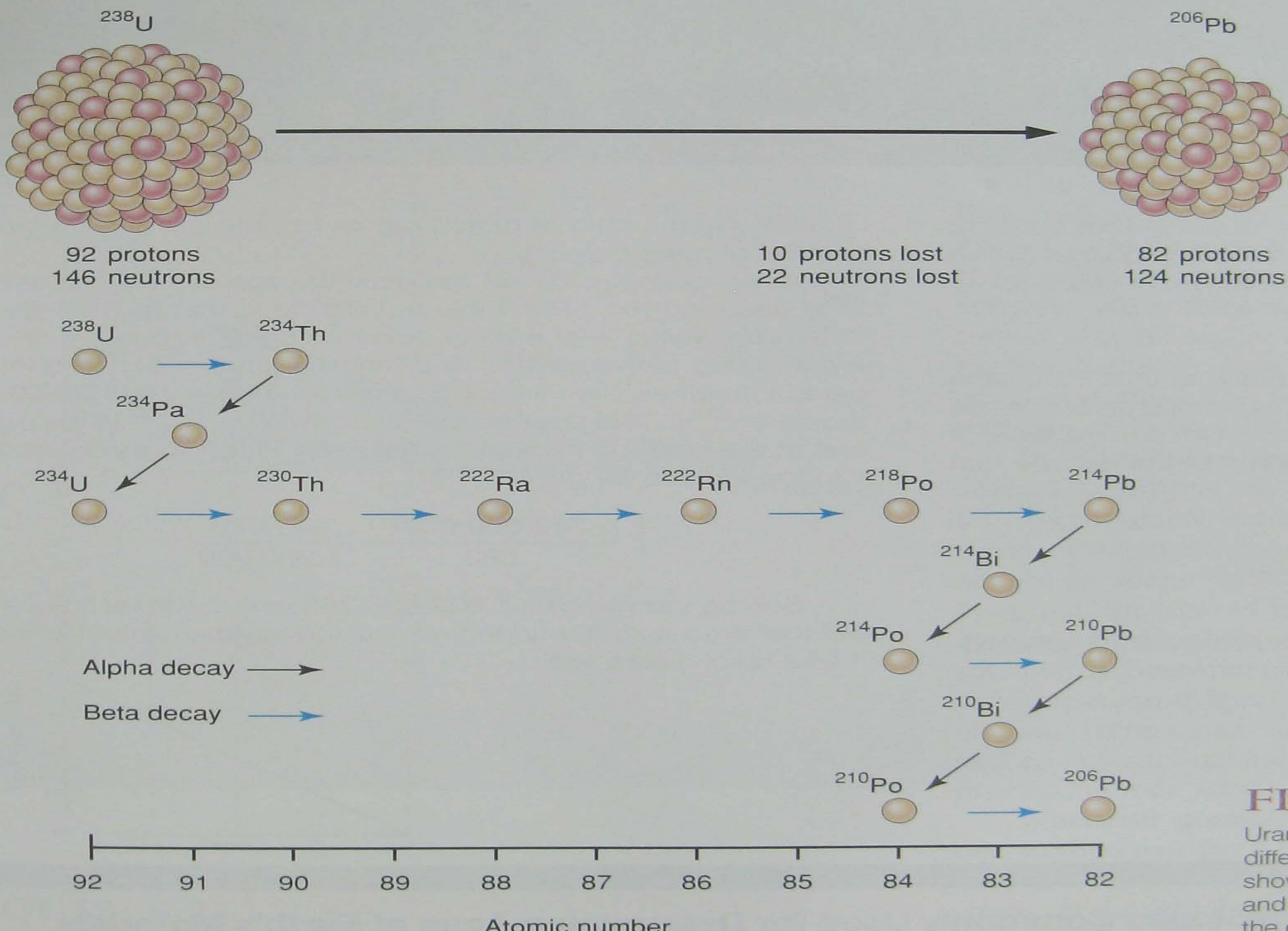
What is uranium?

Heaviest naturally occurring element
about as abundant as arsenic and molybdenum
primary risk is as a heavy metal poison

Three radioactive isotopes: U-238, U-235 & U-234

Radioactive isotopes radiate energy when they decay
alpha & beta particles; gamma rays

Number of decays per gram depends on half life
shorter half life means more radiation



FIG

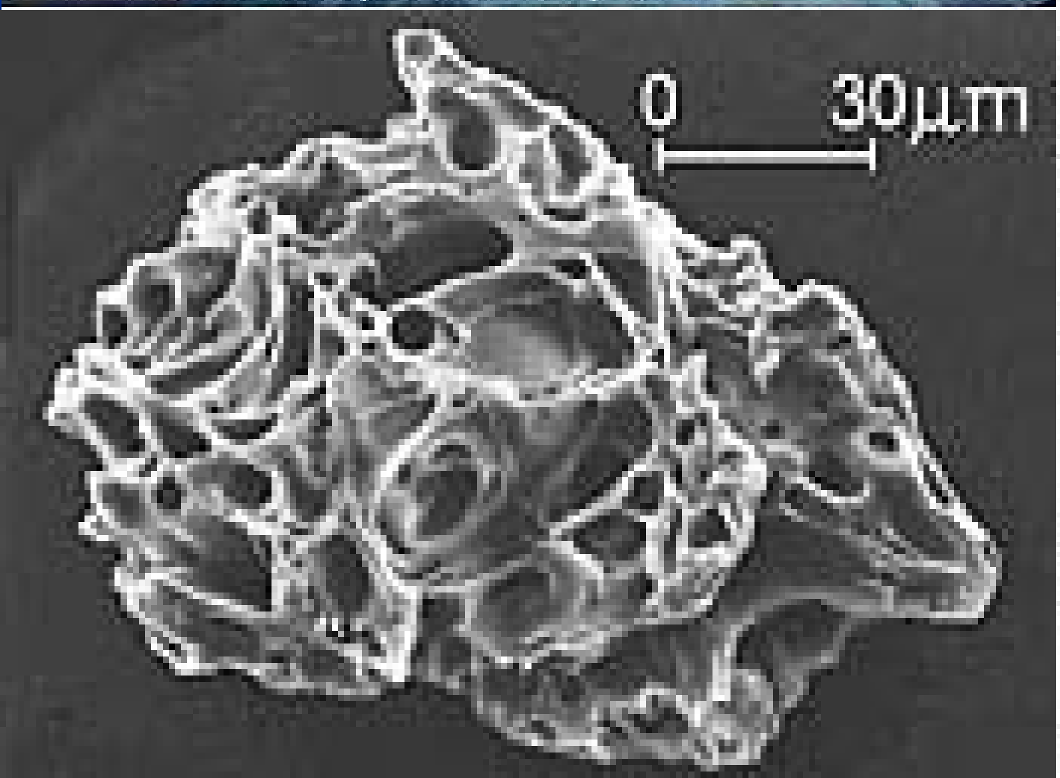
Uraniu
differe
shown
and 20
the ele

What is the source for the uranium found in sandstone ore deposits?

Most economic geologists cite volcanic ash
uranium 5 to 20 ug/g
easily leached and mobilized

Initial low-grade deposits are oxidized and moved
secondary deposits can be higher grade


USGS
USGS Photo by D.A.Swanson, May 18, 1980

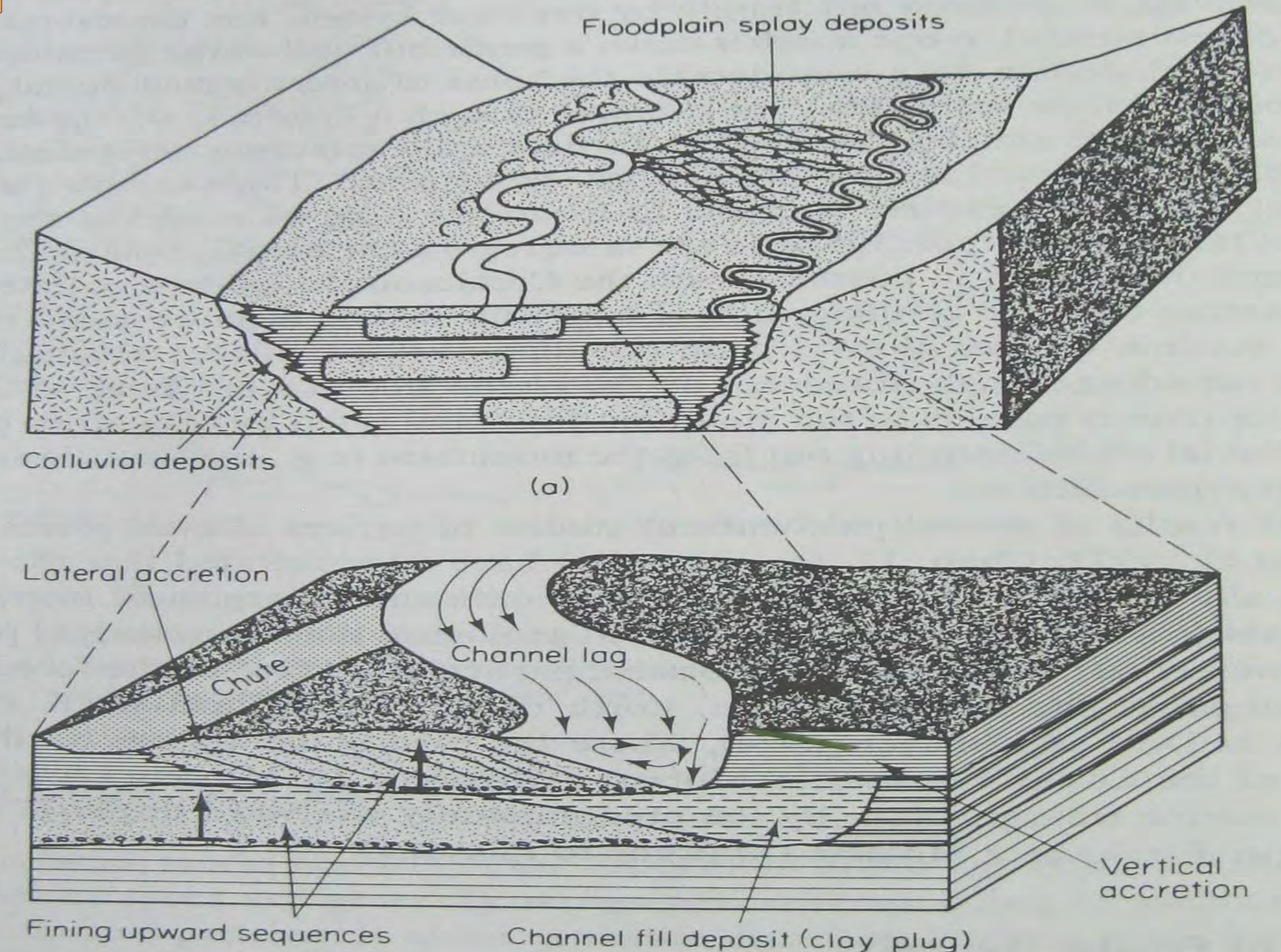

0
30µm

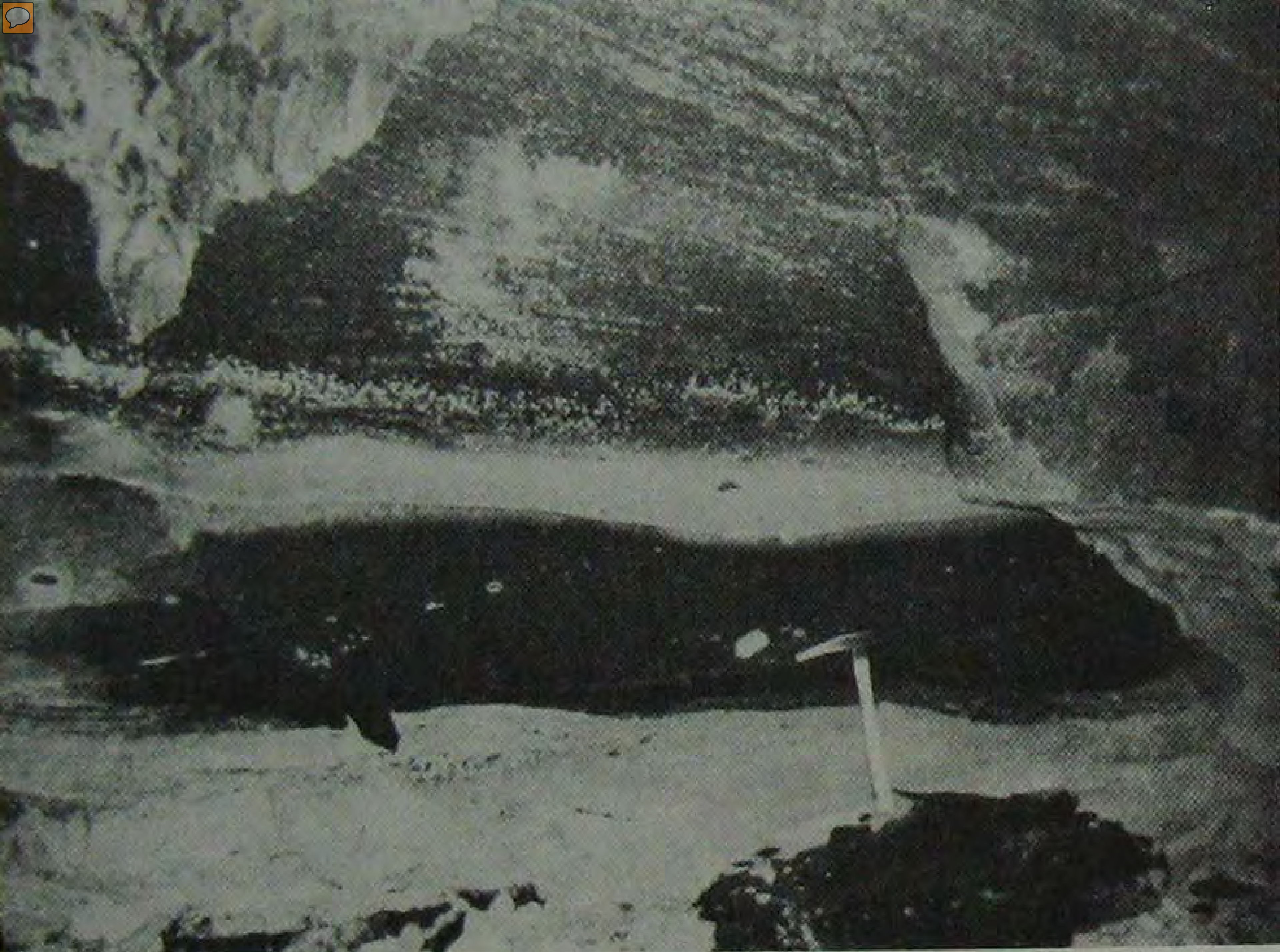
How does a uranium ore deposit form in a fluvial sandstone?

Uranium is transported to a reducing zone
decayed plant debris along stream channel
oxidation-reduction front in buried deposits

Formation of an ore deposit takes hundreds of thousands to millions of years

Principal types are stratabound and roll front


Floodplain splay deposits
Colluvial deposits
(a)
Lateral accretion
Chute
Channel lag
Vertical accretion
Fining upward sequences
Channel fill deposit (clay plug)

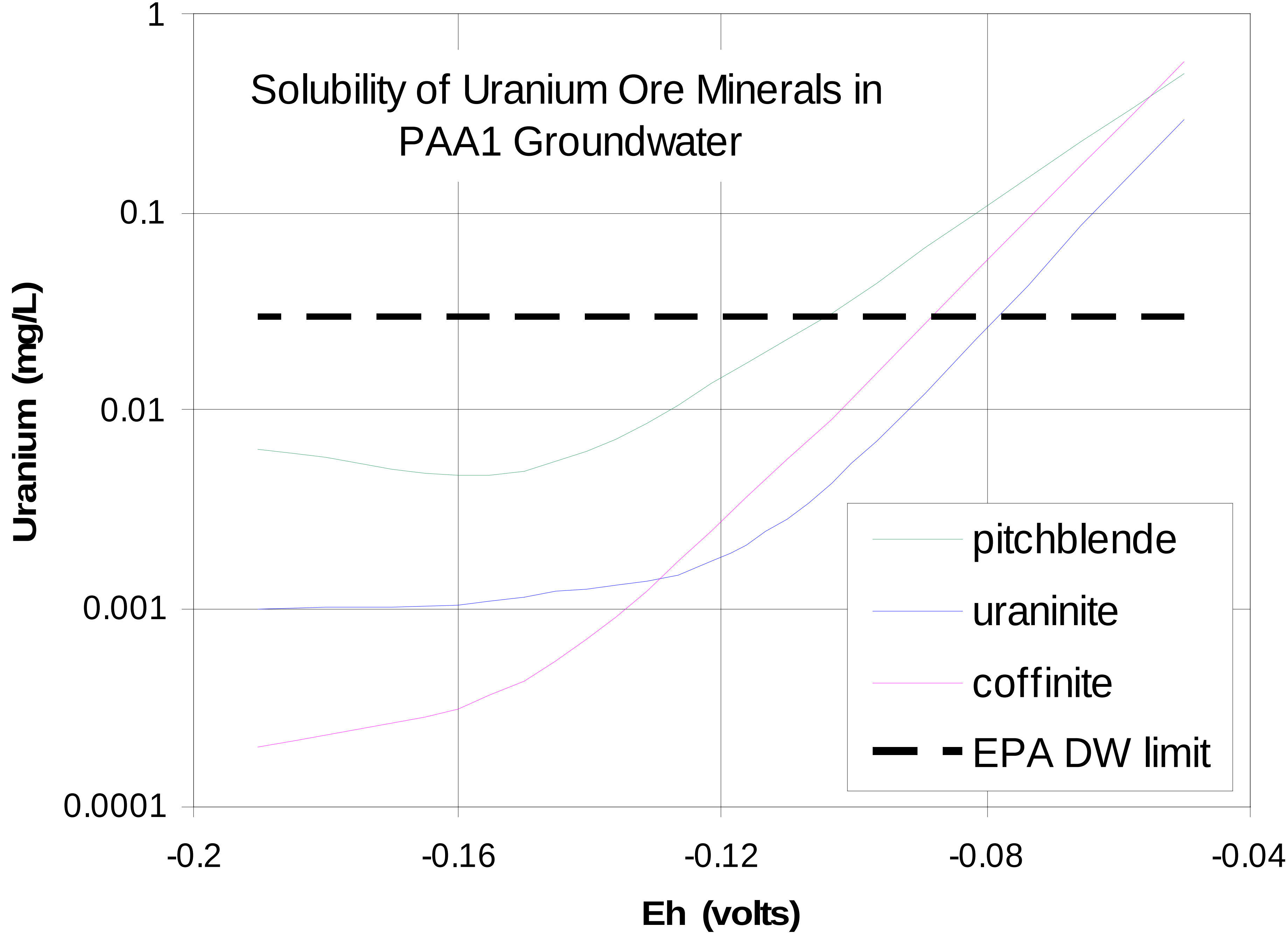


What is the composition of a uranium ore deposit?

Greater than 99 percent of the rock is quartz, feldspar and clay minerals with minor amounts of carbonate and iron minerals

Uranium ore minerals are less than 1 percent of rock generally 0.1 to 0.5 percent of the rock

pitchblende, uraninite, coffinite, carnotite, autunite


Solubility of Uranium Ore Minerals in PAA1 Groundwater
Uranium (mg/L)
1
0.1
0.01
0.001
0.0001
Eh (volts)
-0.2
-0.16
-0.12
-0.08
-0.04
pitchblende
uraninite
coffinite
EPA DW limit

How is the uranium mined?

Conventional – underground mining
extensive surface tailings (rock waste)
Karnes County

ISL Operations – solution mining
inject chemicals to dissolve ore
Kleberg County

What are the ISL Operations?

Identify the ore body with exploratory drilling

Establish baseline water quality & extent of ore

Construct processing facilities, well fields, pipelines, pump houses and tank farms

Inject barren lixiviant and extract pregnant lixiviant

Run pregnant lixiviant through ion exchange

What are the ISL Operations?

Refortify the stripped lixiviant and reinject

Backwash ion exchange columns to strip uranium

Evaporate uranium solution to produce yellow cake

Package and ship the product to enrichment facility

Restore groundwater and surface conditions

Rice (2006) provides details on some operations

What type of monitoring is performed?

Air – radon, particulate and direct radiation

Water – surface pipes and ponds, groundwater

Soil – spills along pipelines and facility releases

Concerns with ISL Operations

Adequate oversight by the regulatory agency

Monitoring requirements for air, water, & soil

Laboratory splits on environmental samples

Comprehensive scientific review of permits

Concerns with ISL Operations

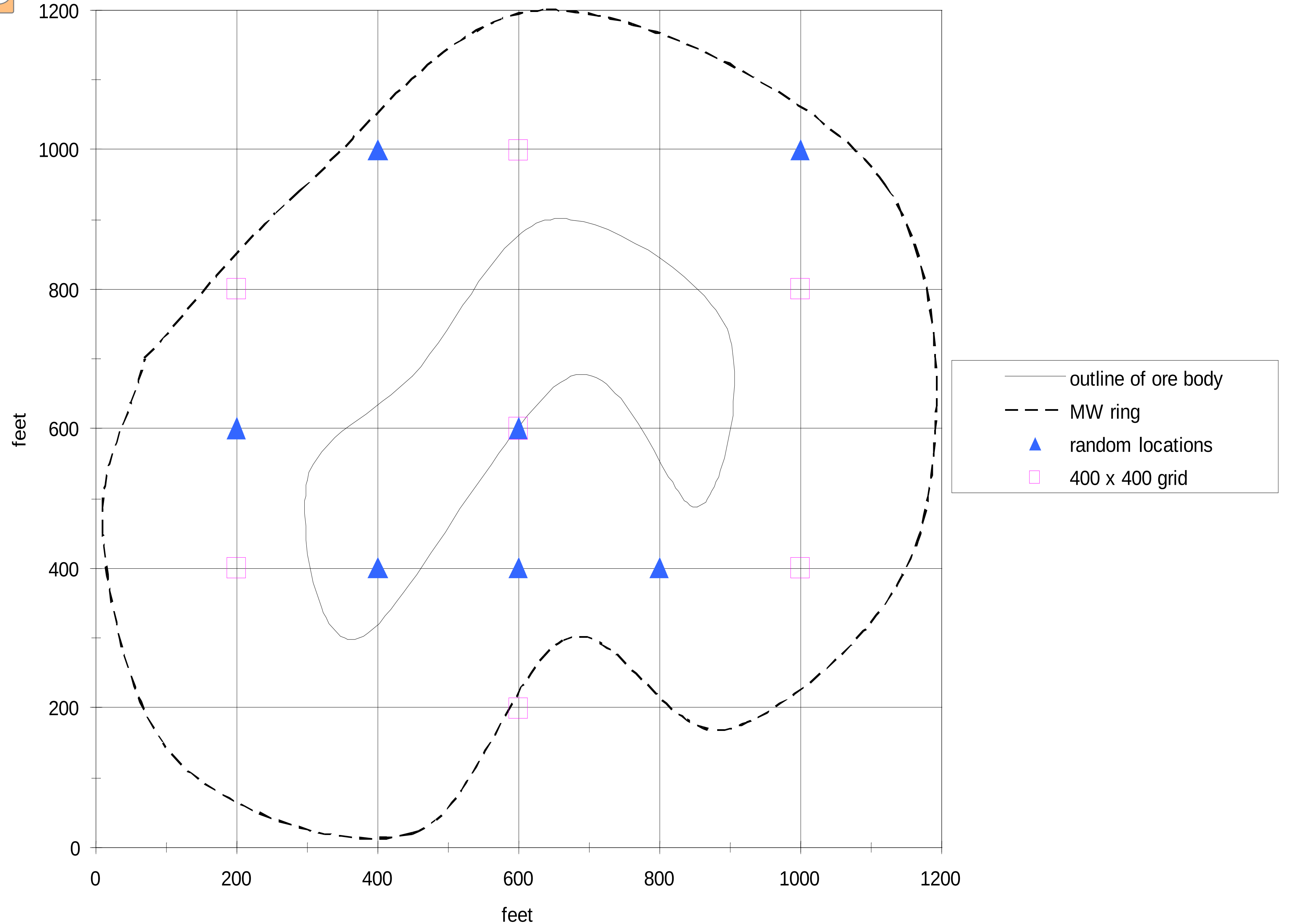
Establishing Baseline Water Quality

Within the MW ring for restoration values
- random well locations on a grid
- generally 1 well per 4 acres

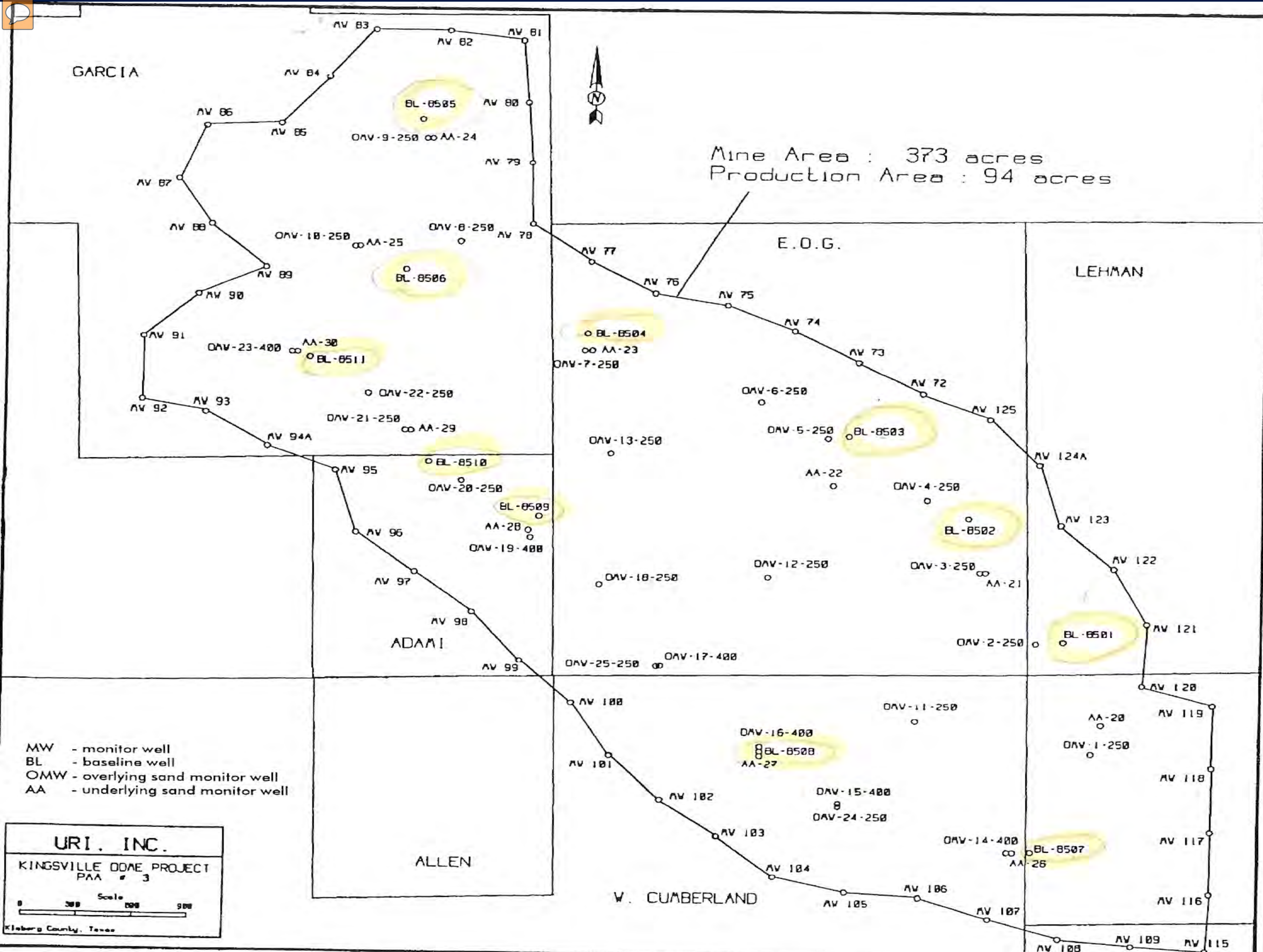
At the MW ring for excursion limits

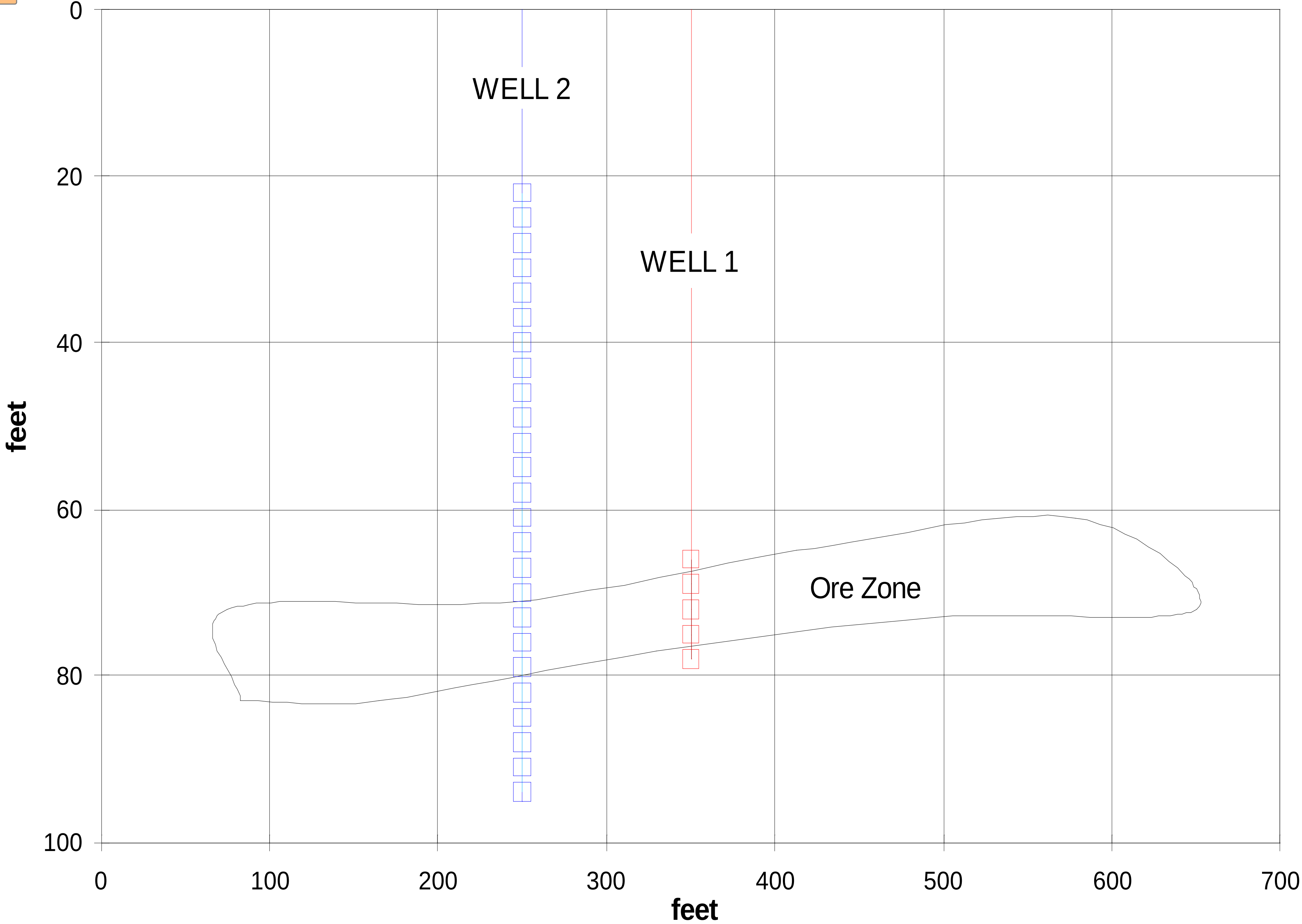
Sample the entire thickness of the aquifer

Use valid statistical tests to analyze the data



1200
1000
800
600
400
200
0
feet
0
200
400
600
800
1000
1200
feet
outline of ore body
MW ring
random locations
400 x 400 grid


GARCIA
E.O.G.
LEHMAN
ADAMI
ALLEN
W. CUMBERLAND
Mine Area : 373 acres
Production Area : 94 acres
AV 81
AV 82
AV 83
AV 84
AV 85
AV 86
AV 87
AV 88
AV 89
AV 90
AV 91
AV 92
AV 93
AV 94A
AV 95
AV 96
AV 97
AV 98
AV 99
AV 100
AV 101
AV 102
AV 103
AV 104
AV 105
AV 106
AV 107
AV 108
AV 109
AV 115
AV 116
AV 117
AV 118
AV 119
AV 120
AV 121
AV 122
AV 123
AV 124A
AV 125
AV 72
AV 73
AV 74
AV 75
AV 76
AV 77
AV 78
AV 79
AV 80
BL-8501
BL-8502
BL-8503
BL-8504
BL-8505
BL-8506
BL-8507
BL-8508
BL-8509
BL-8510
BL-8511
OMV-1-250
OMV-2-250
OMV-3-250
OMV-4-250
OMV-5-250
OMV-6-250
OMV-7-250
OMV-8-250
OMV-9-250
OMV-10-250
OMV-11-250
OMV-12-250
OMV-13-250
OMV-14-400
OMV-15-400
OMV-16-400
OMV-17-400
OMV-18-250
OMV-19-400
OMV-20-250
OMV-21-250
OMV-22-250
OMV-23-400
OMV-24-250
OMV-25-250
AA-20
AA-21
AA-22
AA-23
AA-24
AA-25
AA-26
AA-27
AA-28
AA-29
AA-30
MW - monitor well
BL - baseline well
OMW - overlying sand monitor well
AA - underlying sand monitor well
URI, INC.
KINGSVILLE DOME PROJECT
PAA # 3
Scale
Kleberg County, Texas



WELL 2
WELL 1
Ore Zone
feet
feet
0
20
40
60
80
100
0
100
200
300
400
500
600
700

Reference Documents for Proper Statistical Methods

Statistical Methods for Environmental Pollution Monitoring (Gilbert 1987)

Prescriptions for Working Statisticians (Mandansky 1988)

Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities (EPA 1992)

Visual Sample Plan, Version 5.0 User's Guide (PNNL 2007)

Evaluate Data Distribution

Normal, Lognormal or Other

Probability Plot

Shapiro-Wilks test for normality

Parametric vs Nonparametric Statistics

Mean, Standard Deviation, t-Test

Median, Quartile Range, Sign Test

PAA-3 Baseline Wells
Pre-mining Water Quality Summary

Constituent	Units	Minimum	Average	Maximum
Calcium	mg/L	10	16	25
Magnesium	mg/L	1.5	3.8	6.0
Sodium	mg/L	203	387	480
Potassium	mg/L	7.7	16.1	31.0
Carbonate	mg/L	0	16	49
Bicarbonate	mg/L	95	165	321
Sulfate	mg/L	183	349	487
Chloride	mg/L	138	275	362
Fluoride	mg/L	0.00	0.19	2.10
Nitrate (as N)	mg/L	0.49	0.67	0.97
Silica	mg/L	17	20	23
pH	SU	7.69	8.70	9.6
TDS	mg/L	667	1143	1440
EC	µmhos	1120	1825	2820
Alkalinity	mg/L	78	162	263
Arsenic	mg/L	0.003	0.009	0.025
Cadmium	mg/L	<0.0001	NA	0.0001
Iron	mg/L	<0.01	0.01	0.04
Lead	mg/L	<0.001	NA	0.001
Manganese	mg/L	<0.01	NA	0.01
Mercury	mg/L	<0.0001	<0.0001	<0.0001
Selenium	mg/L	<0.001	0.014	0.063
Ammonia	mg/L	<0.01	0.18	0.40
Molybdenum	mg/L	0.02	0.30	3.20
Radium 226	pCi/L	0.3	23.3	78
Uranium	mg/L	0.032	0.351	1.54

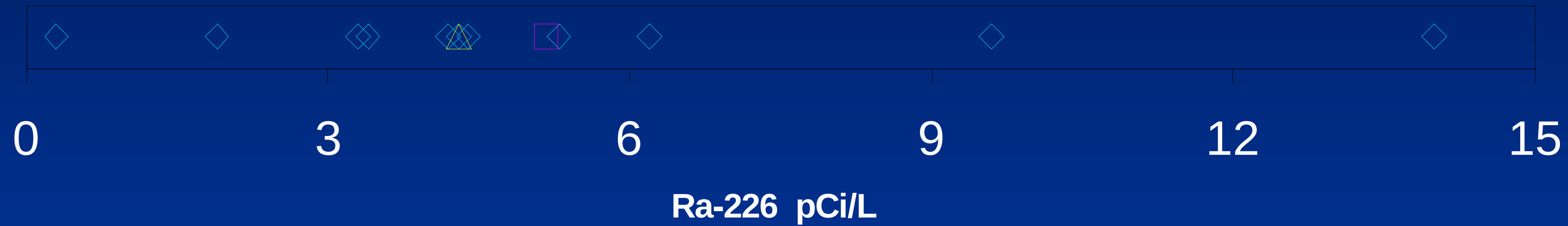
Source:

Rice (2006)

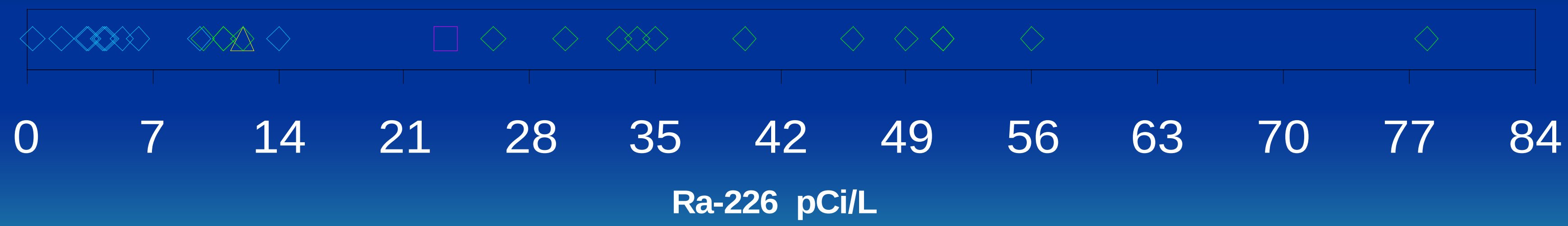
Effects of URI's KVD Mine on Groundwater Quality

Ra-226 baseline at PAA3

Initially 11 baseline wells (BL8501 - BL8511)



16 additional wells added to baseline at a later date



Excursion Limits for MW ring

As noted in Appendix C of “Effects of URI's Kingsville Dome Mine on Groundwater Quality” (Rice 2006), excursio limits were improperly calculated at PAA1, PAA2 & PAA3

Present excursion limits for electric conductivity, chloride and uranium are arbitrary and statistically invalid

Guidance of NRC and EPA was not followed, which allows contamination to pass monitoring wells with no action taker

Proper Statistical Methods for Excursion Limits

Sample each well 3 to 4 times and use Shapiro-Wilkes test to evaluate the data distribution of each well

Perform ANOVA (normal or lognormal) to determine if the wells have ions with a similar range in concentration

If individual wells have similar ion concentrations, all wells can be used in the SWT.

Wells that fail SWT or those that have dissimilar ion concentrations must be treated independently

Proper Statistical Methods for Excursion Limits

If normal or log normal, calculate the upper tolerance limit for the wells that can be grouped, per ANOVA results

Individual wells that are not normal or lognormal must be evaluated independently using maximum value for the upper tolerance limit

Summary of tolerance limit calculations for PAA1, PAA2 and PAA3 in Appendix C of 'Effects of URI's Kingsville Dome Mine on Groundwater Quality' (Rice 2006)

Option to use Shewhart-cumulative sum chart for data that are distributed normal or lognormal

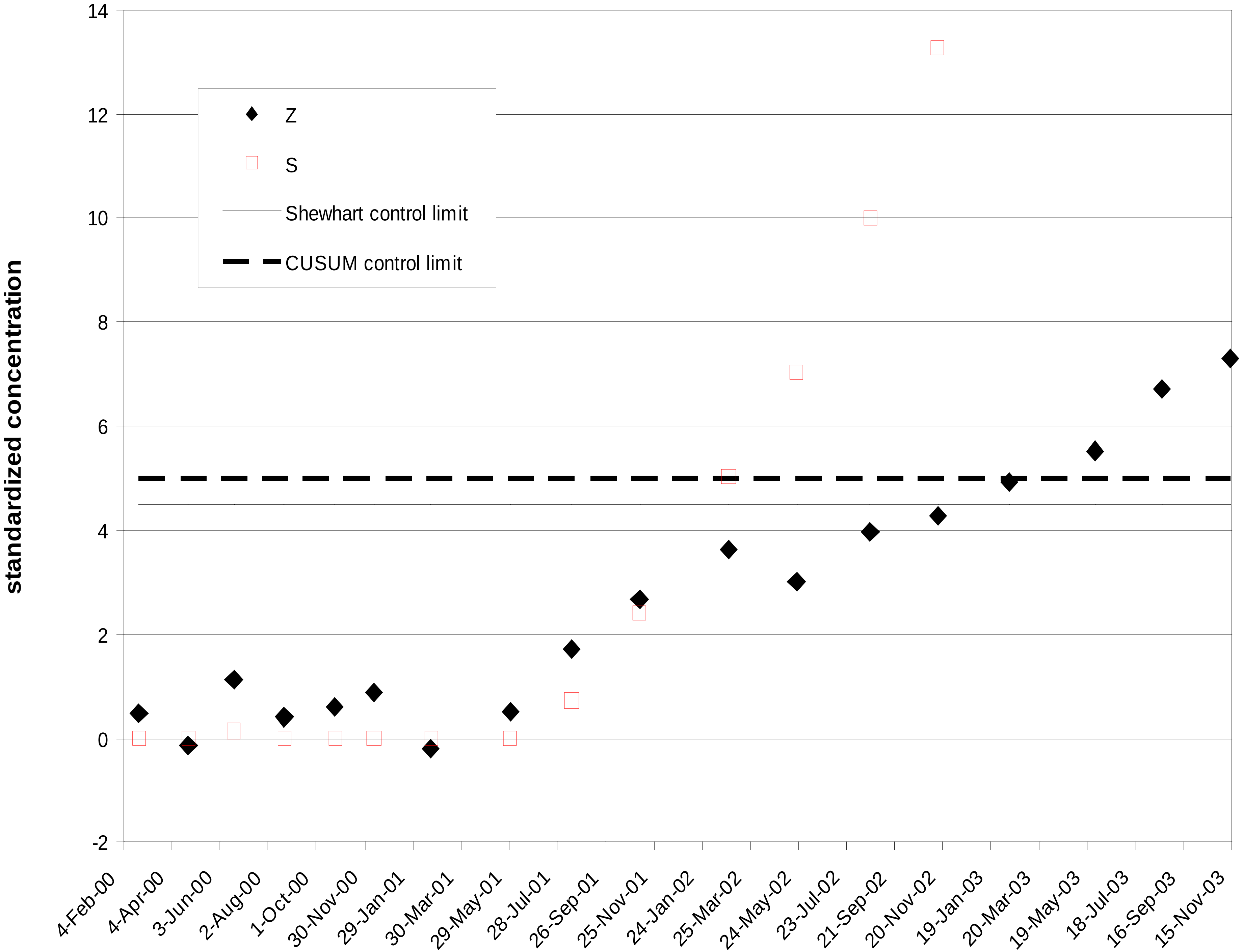
Control Chart for Monitoring Wells

Combined Shewhart – cumulative sum, if data are independently distributed & normal or log normal

Contamination at well monitored in two ways: Shewhart control limit (SCL) & cumulative sum (CUSUM)

SCL: standardized mean (Z) for the given sample period exceeds 4.5 (rapid increase in contamination)

CUSUM: cumulative sum (S) of Z over all sampling periods exceeds 5 (rapid or gradual increase in contamination)



standardized concentration
14
12
10
8
6
4
2
0
-2
Z
S
Shewhart control limit
CUSUM control limit
4-Feb-00
4-Apr-00
3-Jun-00
2-Aug-00
1-Oct-00
30-Nov-00
29-Jan-01
30-Mar-01
29-May-01
28-Jul-01
26-Sep-01
25-Nov-01
24-Jan-02
25-Mar-02
24-May-02
23-Jul-02
21-Sep-02
20-Nov-02
19-Jan-03
20-Mar-03
19-May-03
18-Jul-03
16-Sep-03
15-Nov-03

Concerns with ISL Operations

Restoring groundwater to pre-mining levels

Never achieved at an ISL mine

Rice (2006) documented failure to restore
at KVD's PAA1 and PAA2

Long-term risk of contamination at private wells
uranium, radium, arsenic, selenium

PAA-1 Baseline Wells
Post-mining Water Quality

Baseline Well ID	Date	pH (SU)	EC (µmhos/cm)	U (mg/L)	Cl (mg/L)	Ca (mg/L)	HCO3 (mg/L)	SO4 (mg/L)	Mo (mg/L)
EX-1	-	-	-	-	-	-	-	-	-
EX-2	2/9/06	7.8	2590	1.53	253	166	376	655	0.01
EX-3	2/27/06	6.7	1441	1.78	160	151	383	165	0.06
I-1	2/9/06	6.9	2670	0.509	339	226	421	632	1.50
I-2	2/9/06	7.8	1619	0.093	239	386	402	154	0.01
I-3	2/27/06	7.0	2730	2.63	339	229	434	361	0.04
I-4	2/9/06	7.0	1785	0.0	246	220	377	297	1.60
I-5	2/9/06	6.8	1466	2.04	160	138	371	269	2.10
I-6	2/27/06	10.6	4270	0.085	1210	396	634	69	0.04
I-7	2/9/06	7.2	2010	0.085	273	207	377	354	3.80
I-8	2/9/06	7.0	1135	0.636	133	339	333	142	1.00
I-9	2/9/06	6.8	1677	0.932	140	201	390	422	2.60
I-10	2/9/06	7.4	1443	0.195	146	298	484	136	3.50
I-11	2/9/06	6.8	1197	1.27	100	273	346	226	1.60
I-12	2/9/06	6.9	3300	0.0	346	220	465	495	2.20
I-13	2/9/06	7.5	1544	2.63	240	254	320	127	0.55
Average	-	7.35	2058	0.961	288	247	408	300	1.37
State equirement		8.74	1717	0.164	234	20.8	268	204	0.06
leets State equirement?		-	No	No	No	No	No	No	No
State Restoration ange Table pper Value		7.37 – 9.5	2100	1.89	352	74	505	310	0.84
Less Than pper Value?		No	Yes	Yes	Yes	No	Yes	Yes	No

Source:

Rice (2006)

PAA-2 Baseline Wells
Post-mining Water Quality

Baseline Well ID	Date	pH (SU)	EC (µmhos/cm)	U (mg/L)	Cl (mg/L)	Ca (mg/L)	HCO3 (mg/L)	SO4 (mg/L)	Mo (mg/L)
47	5/31/06	6.8	4940	9.50	692	358	695	1376	1.86
047	2/27/06	6.9	3630	0.170	891	270	94	394	0.05
240	2/9/06	7.4	1785	0.170	246	693	352	301	0.63
265	2/27/06	6.8	1518	1.27	166	166	421	204	0.12
491	2/9/06	7.6	1580	2.63	240	370	377	226	0.26
Average	-	7.1	2691	2.75	447	371	388	500	0.58
State quirement		7.37 – 8.66	1662	1.89	224	25.3	327	224	0.38
eets State quirement?		No	No	No	No	No	No	No	No
State estoration nge Table per Value		7.37 – 9.5	2100	1.89	352	74	505	310	0.84
ess Than per Value?		No	No	No	No	No	Yes	No	Yes

Source:

Rice (2006)

Consideration of Geochemical Issues in Groundwater Restoration at Uranium In Situ Leach Mining Facilities

NUREG/CR-6870 January 2007

Prepared by USGS for NRC

- …it is difficult to predict how much time is required or even if the reducing conditions will return via natural processes. The mining disturbance introduces a considerable amount of oxidant to the mined region.....

Consideration of Geochemical Issues in Groundwater Restoration at Uranium In Situ Leach Mining Facilities

NUREG/CR-6870 January 2007

Prepared by USGS for NRC

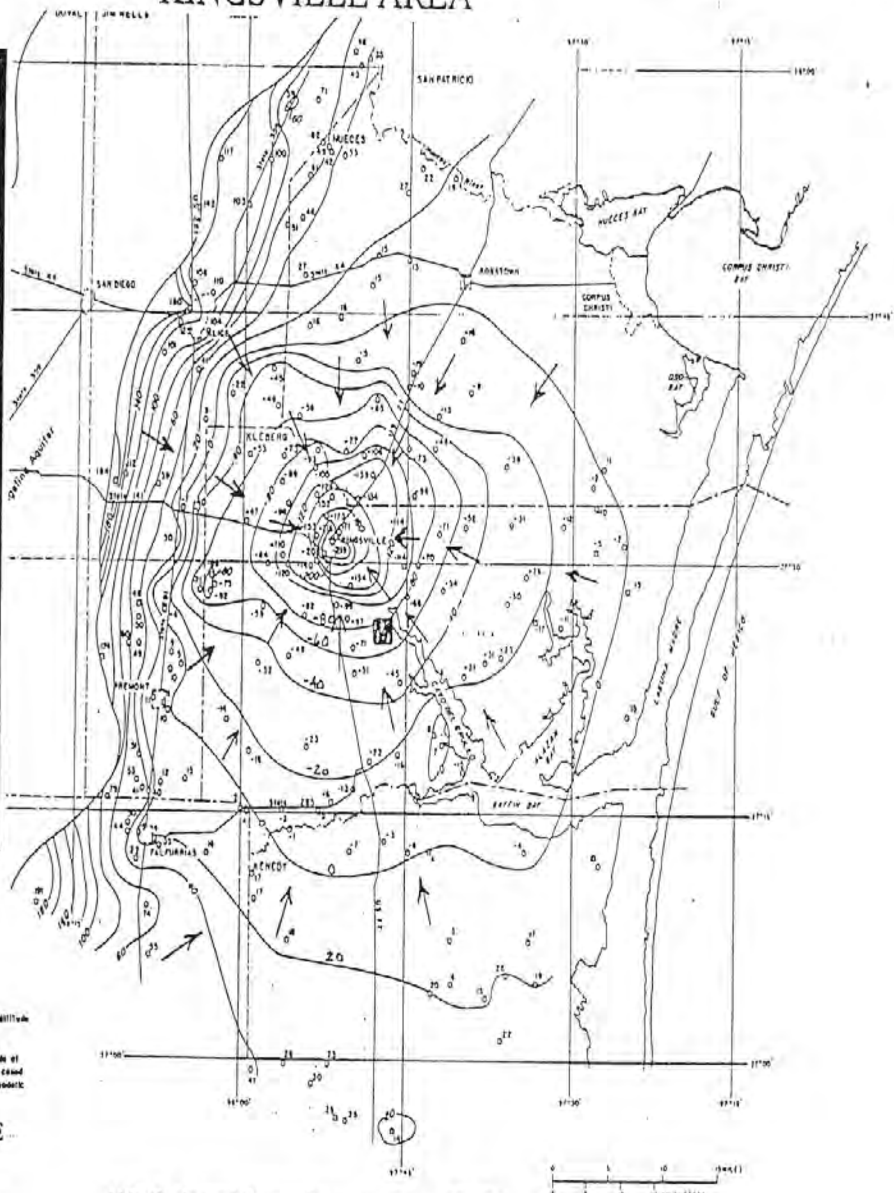
- …Lixiviant that has mixed into the groundwater with lower mobility during the mining operations (and mineral surfaces exposed to that groundwater) will continue to provide a source of contamination even after long periods of pumping and treatment.....

GROUND WATER LEVELS AND DIRECTION OF FLOW IN GOLIAD SAND KINGSVILLE AREA

The 1982 water level map of the Goliad Sand shows a pattern of concentric circles with the lines becoming closer together near the center. This pattern is called a cone of depression and is formed around major ground water discharges.

The center is an area of low pressure and causes ground water to flow toward it from all directions. In Kelberg County, the cone of depression has developed from pumping ground water in Kingsville for many decades.

The URI mine sites are well within this cone of depression.



EXPLANATION

WELL USED FOR CONTROL -- Number is altitude of water levels

— 60 — WATER-LEVEL CONTOUR-- Shows altitude at which water level would have stood in tightly cased wells. Contour interval 20 feet. National Geodetic Vertical Datum of 1929

URI'S PAA3# SITE

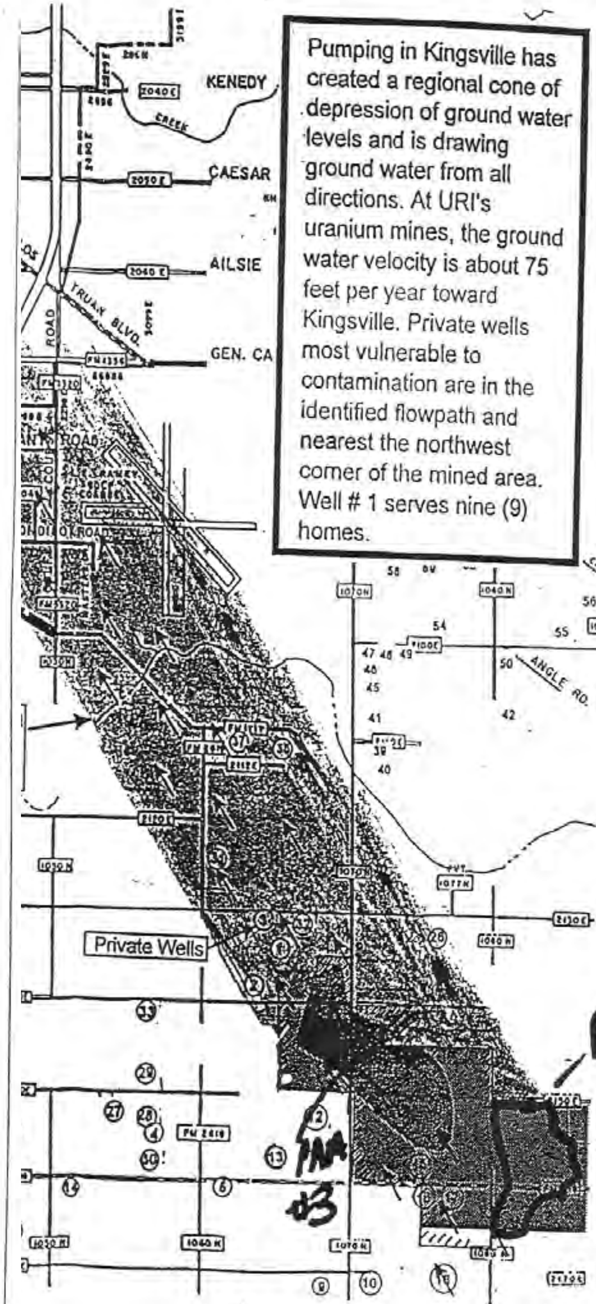
DIRECTION OF GROUND-WATER FLOW

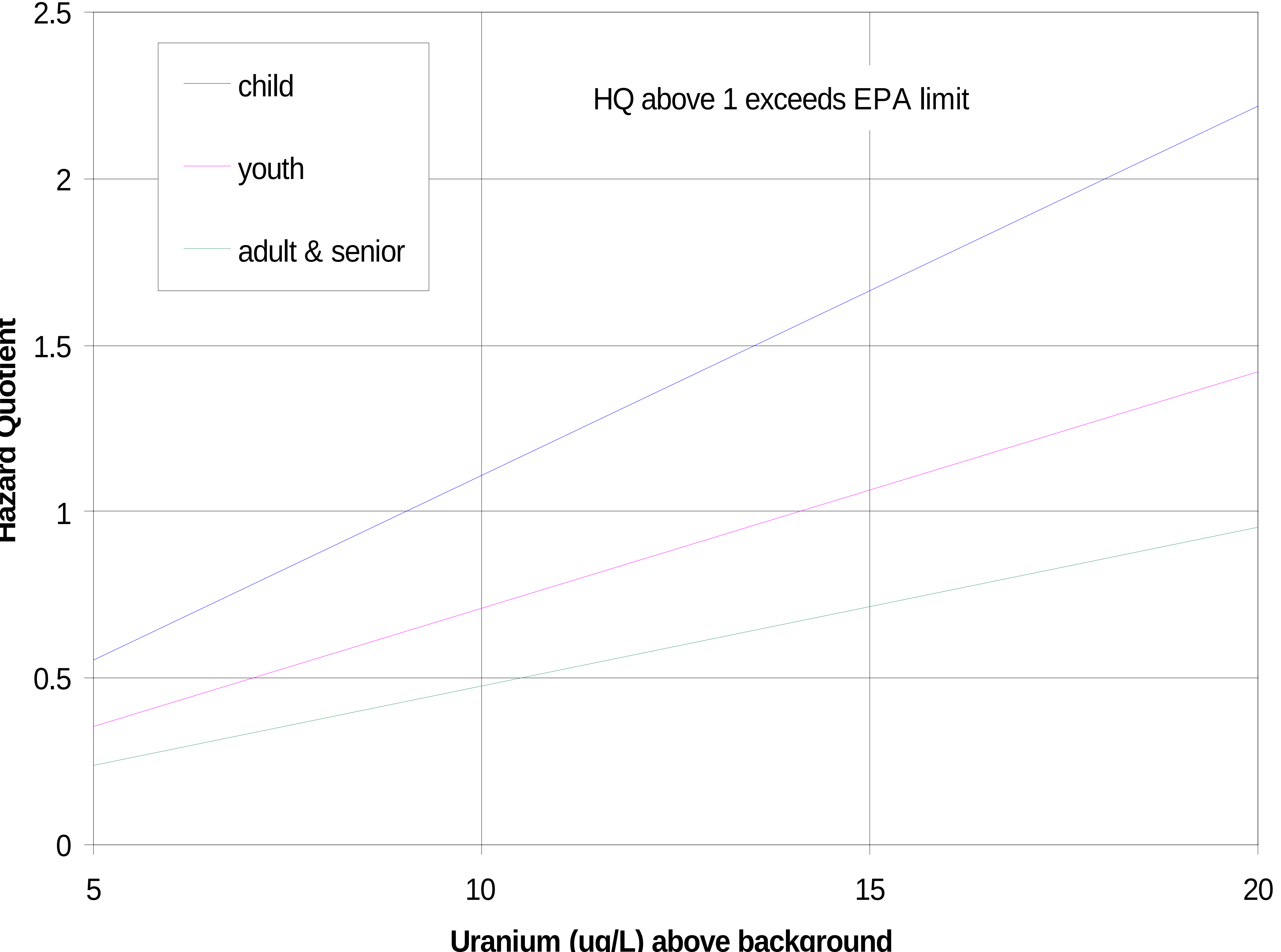
U.S. Geological Survey Open-File Report 82-174

Draft

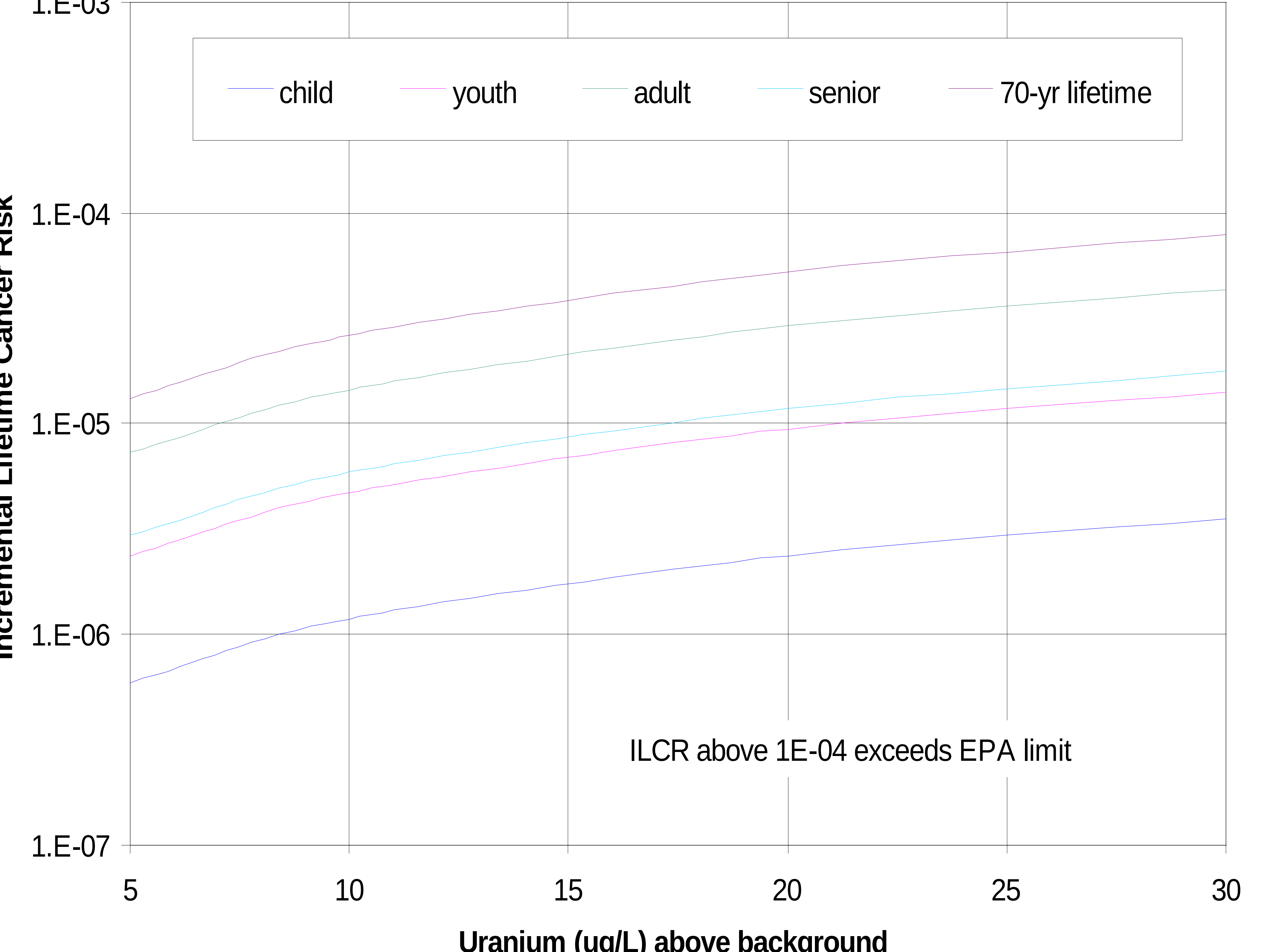
GROUND WATER FLOWPATH

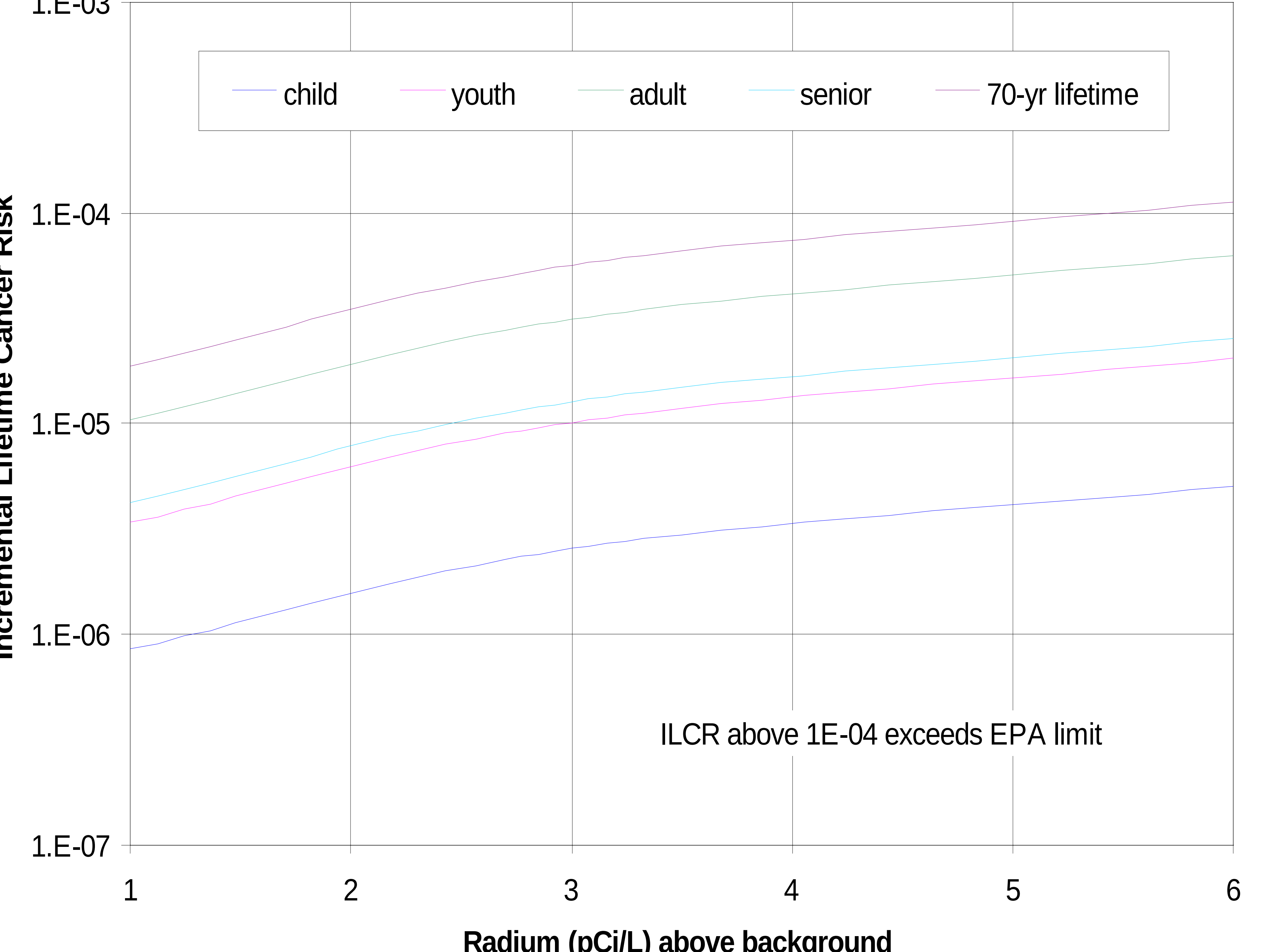
Pumping in Kingsville has created a regional cone of depression of ground water levels and is drawing ground water from all directions. At URI's uranium mines, the ground water velocity is about 75 feet per year toward Kingsville. Private wells most vulnerable to contamination are in the identified flowpath and nearest the northwest corner of the mined area. Well # 1 serves nine (9) homes.



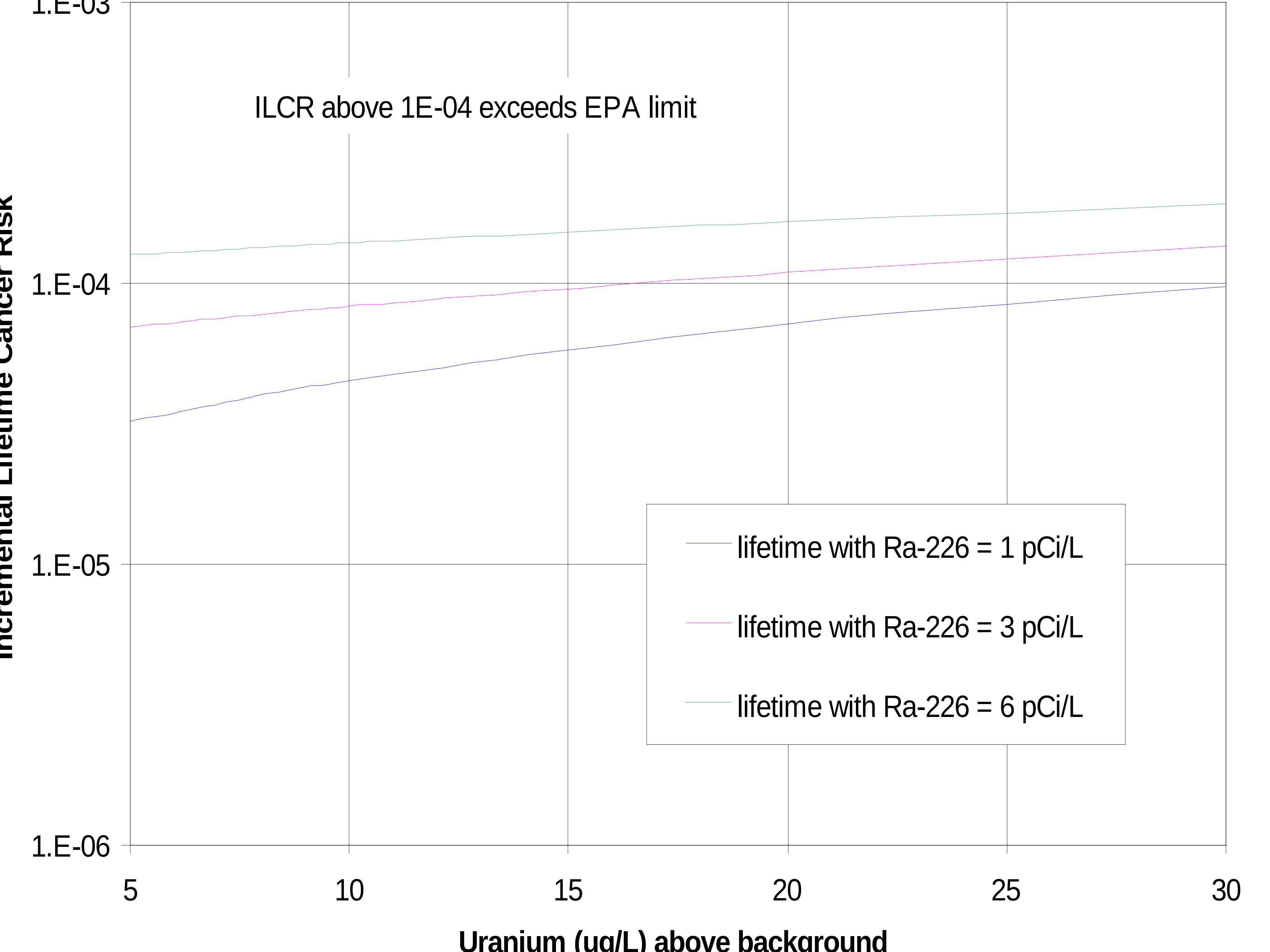


child
youth
adult & senior
HQ above 1 exceeds EPA limit
Hazard Quotient
2.5
2
1.5
1
0.5
0
5
10
15
20
Uranium (ug/L) above background


1.E-03
1.E-04
1.E-05
1.E-06
1.E-07
child
youth
adult
senior
70-yr lifetime
ILCR above 1E-04 exceeds EPA limit
5
10
15
20
25
30
Incremental Lifetime Cancer Risk
Uranium (ug/L) above background



1.E-03
1.E-04
1.E-05
1.E-06
1.E-07
child
youth
adult
senior
70-yr lifetime
ILCR above 1E-04 exceeds EPA limit
1
2
3
4
5
6
Incremental Lifetime Cancer Risk
Radium (pCi/L) above background

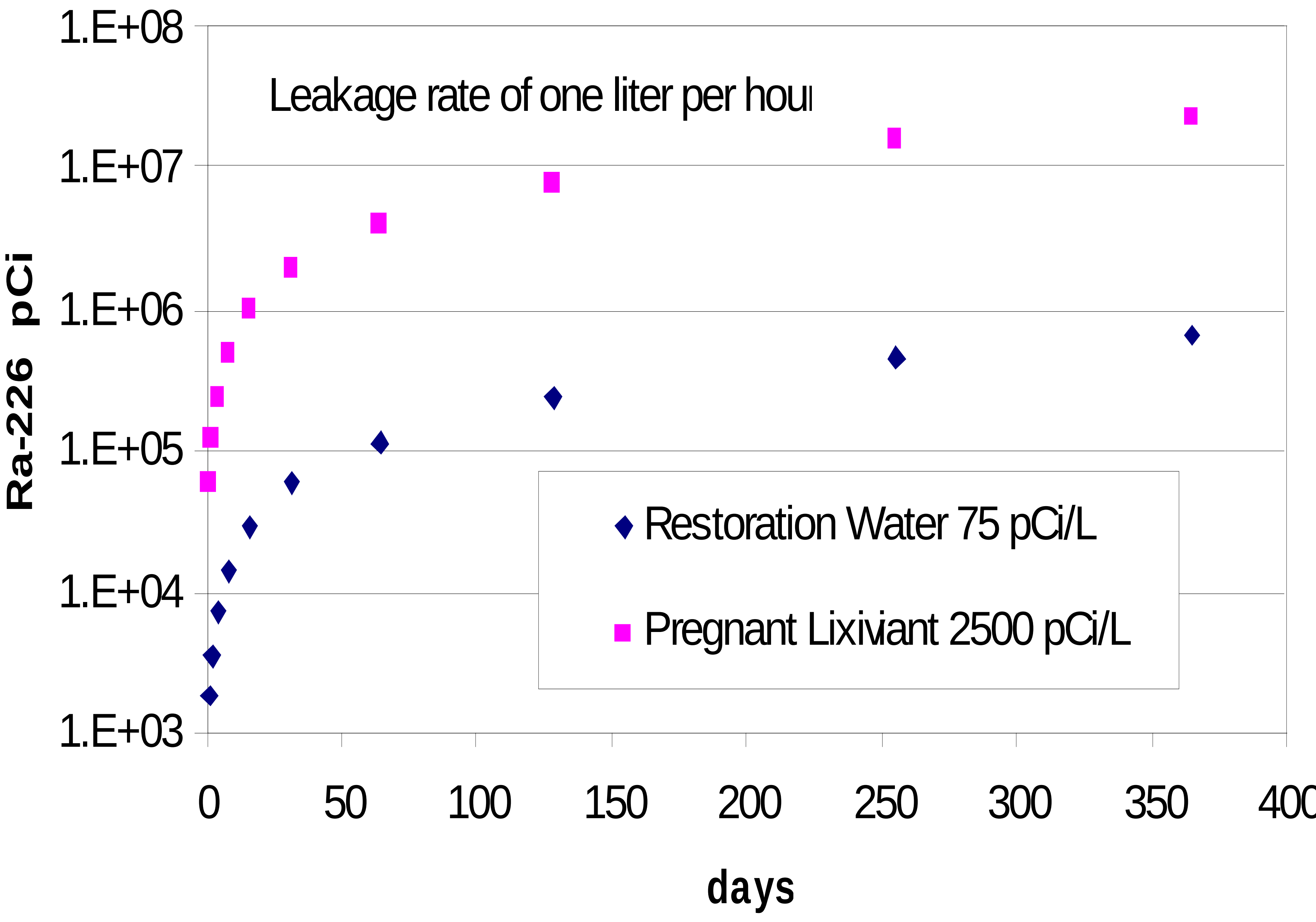

1.E-03
1.E-04
1.E-05
1.E-06
Incremental Lifetime Cancer Risk
ILCR above 1E-04 exceeds EPA limit
lifetime with Ra-226 = 1 pCi/L
lifetime with Ra-226 = 3 pCi/L
lifetime with Ra-226 = 6 pCi/L
5
10
15
20
25
30
Uranium (ug/L) above background

Concerns with ISL Operations

Soil Contamination from Spills & Fallout

Slow leaks in pipes do not trigger alarm
large volume over a long period of time

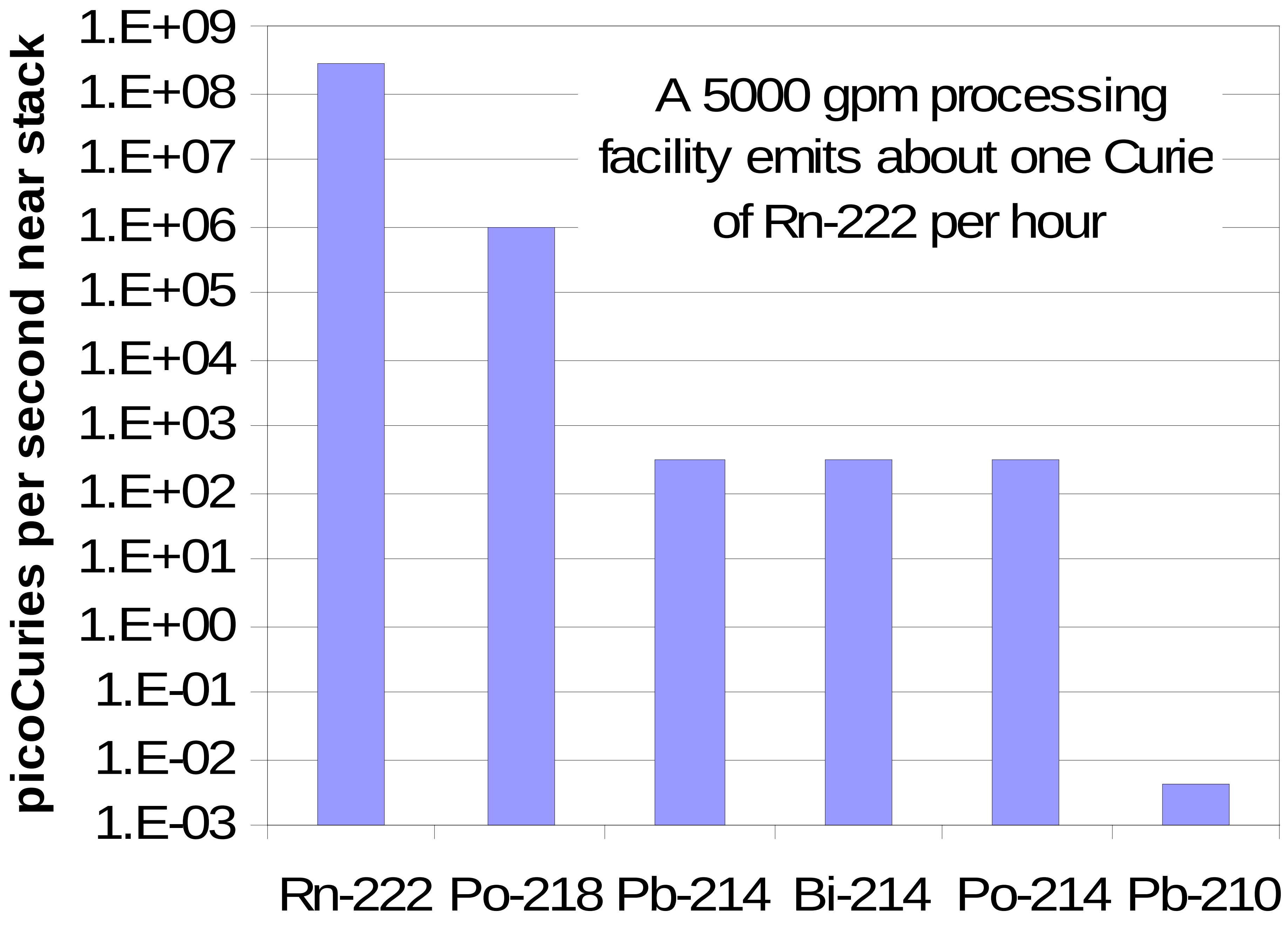
Radioactive fallout of radon daughters
thousands of Curies per year
one Curie is 1,000 billion picoCuries


Leakage rate of one liter per hour
Ra-226 pCi
days
Restoration Water 75 pCi/L
Pregnant Lixiviant 2500 pCi/L
1.E+08
1.E+07
1.E+06
1.E+05
1.E+04
1.E+03
0
50
100
150
200
250
300
350
400

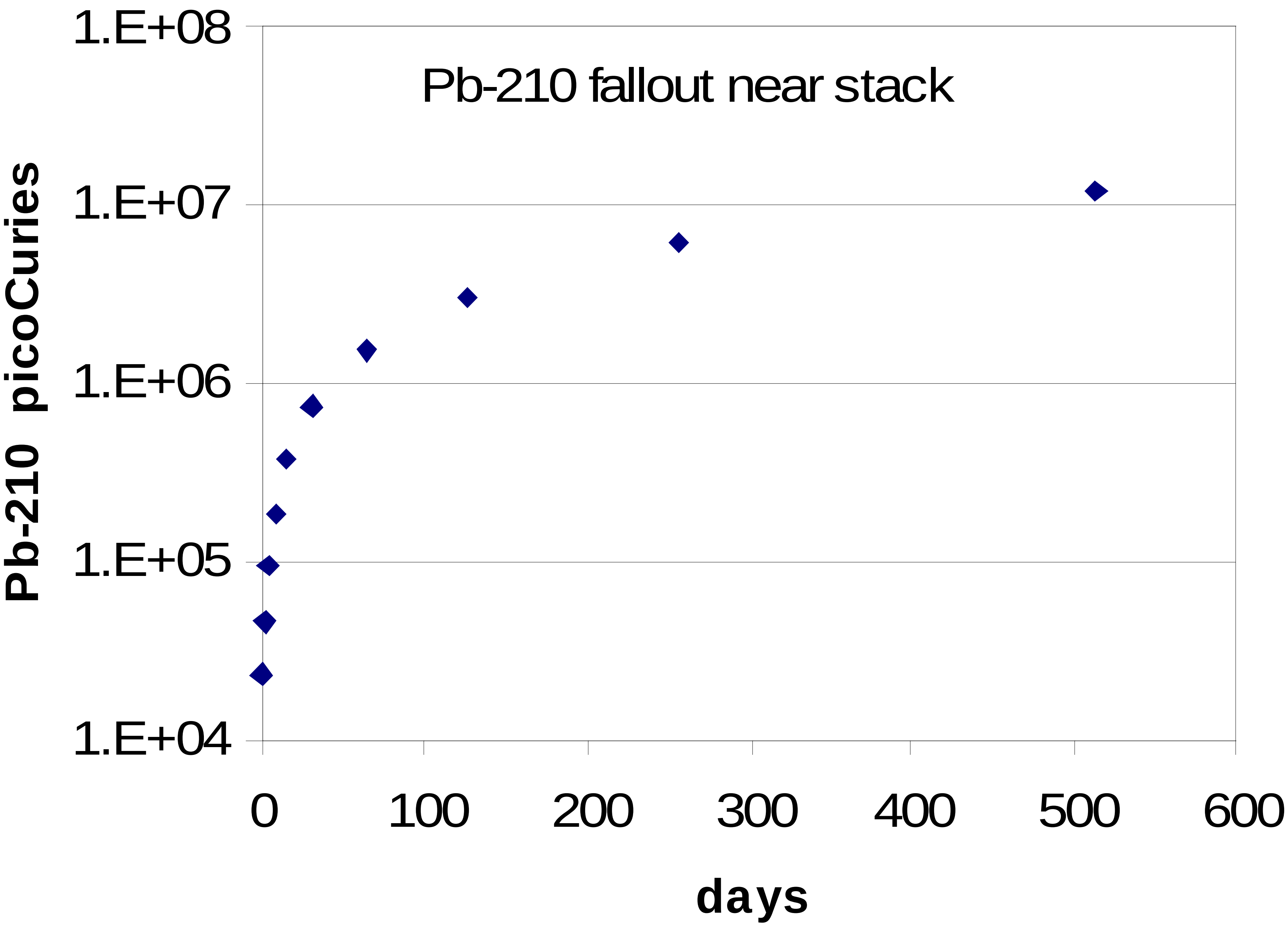
Risk associated with Ra-226 spill

If undetected and soil level reaches 100 pCi/g
Pipeline on resident property for 6 yrs
Resident is near pipe 1 hr/day 300 days/yr
ILCR = 1.36E-4, exceeds EPA limit of 1E-4

If undetected and soil level reaches 300 pCi/g
Child at school bus stop near pipeline for 6 yrs
180 days per year for one-half hour
ILCR = 1.18E-4, exceeds EPA limit of 1E-4



picoCuries per second near stack
1.E+09
1.E+08
1.E+07
1.E+06
1.E+05
1.E+04
1.E+03
1.E+02
1.E+01
1.E+00
1.E-01
1.E-02
1.E-03
A 5000 gpm processing facility emits about one Curie of Rn-222 per hour
Rn-222
Po-218
Pb-214
Bi-214
Po-214
Pb-210



Pb-210 fallout near stack
Pb-210 picoCuries
1.E+08
1.E+07
1.E+06
1.E+05
1.E+04
0
100
200
300
400
500
600
days

Risk associated with Pb-210 fallout

If resident is in fallout zone for 10 yrs
Outdoors 1 hour per day for 300 days/yr
Relaxing and breathing 3 pCi/m^3 at 1 m^3/hr
ILCR = 1.25E-4, exceeds EPA limit of 1E-4

If worker is in fallout zone for 2 yrs
Outdoors 4 hour per day for 300 days/yr
Working and breathing 3 pCi/m^3 at 1.5 m^3/hr
ILCR = 1.5E-4, exceeds EPA limit of 1E-4

PR with Mining Companies

Perform a Background Search

Financial stability

Resumes of personnel

Past operating experience

Environmental record

PR with Mining Companies

Request data for factual statements

Were the samples located & collected properly?

Did an approved lab analyze the samples?

What statistical methods were used on the data?

Cite all guidance documents that were followed

PR with Mining Companies

Demand integrity & honesty in their actions

If you care for the community, why are you not providing the data we ask for?

Why are you not using valid statistical methods to derive your baseline water quality values?

If facts are facts, where are the data to support the facts you are citing?

	DATE	U (mg/L)
Garcia - old well	26-May-87	0.014
Garcia - old well	31-Mar-88	0.011
Garcia - new well	13-Dec-96	0.184
Garcia - new well	23-May-97	0.220
Garcia - new well	29-Aug-97	0.152
Garcia - new well	25-Feb-98	0.189
Garcia - new well	27-Aug-98	0.158
Garcia - new well	25-Nov-98	0.209
Garcia - new well	26-Mar-99	0.200
Garcia - new well	21-Jun-99	0.181
Garcia - new well	24-Aug-00	0.151
Garcia - new well	19-Sep-00	0.187
Garcia - new well	6-Nov-00	0.168
Garcia - new well	19-Feb-01	0.184
Garcia - new well	11-Jun-01	0.179
Garcia - new well	13-Sep-01	0.160
Garcia - new well	17-Dec-01	0.240
Garcia - new well	21-Mar-02	0.164
Garcia - new well	26-Jun-02	0.141
Garcia - new well	30-Sep-02	0.172
Garcia - new well	13-Dec-02	0.188
Garcia - new well	11-Mar-03	0.180
Garcia - new well	23-Jun-03	0.172
Garcia - new well	26-Sep-03	0.170
Garcia - new well	12-Dec-03	0.187

Where are the data for the new well for the period 1989 to 1996?

Can you sample the old well to demonstrate that uranium is still at the level observed in 1988?

If you refuse, you are disingenuous in your claim to care for the community.

PR with Mining Companies

Require clear definitions of terms

Restoration values – values established improperly by mining company and regulators to set groundwater restoration goals and bonding (subject to change by regulators).

Premining levels for contaminants – levels that are naturally occurring in the groundwater prior to mining and do not change.

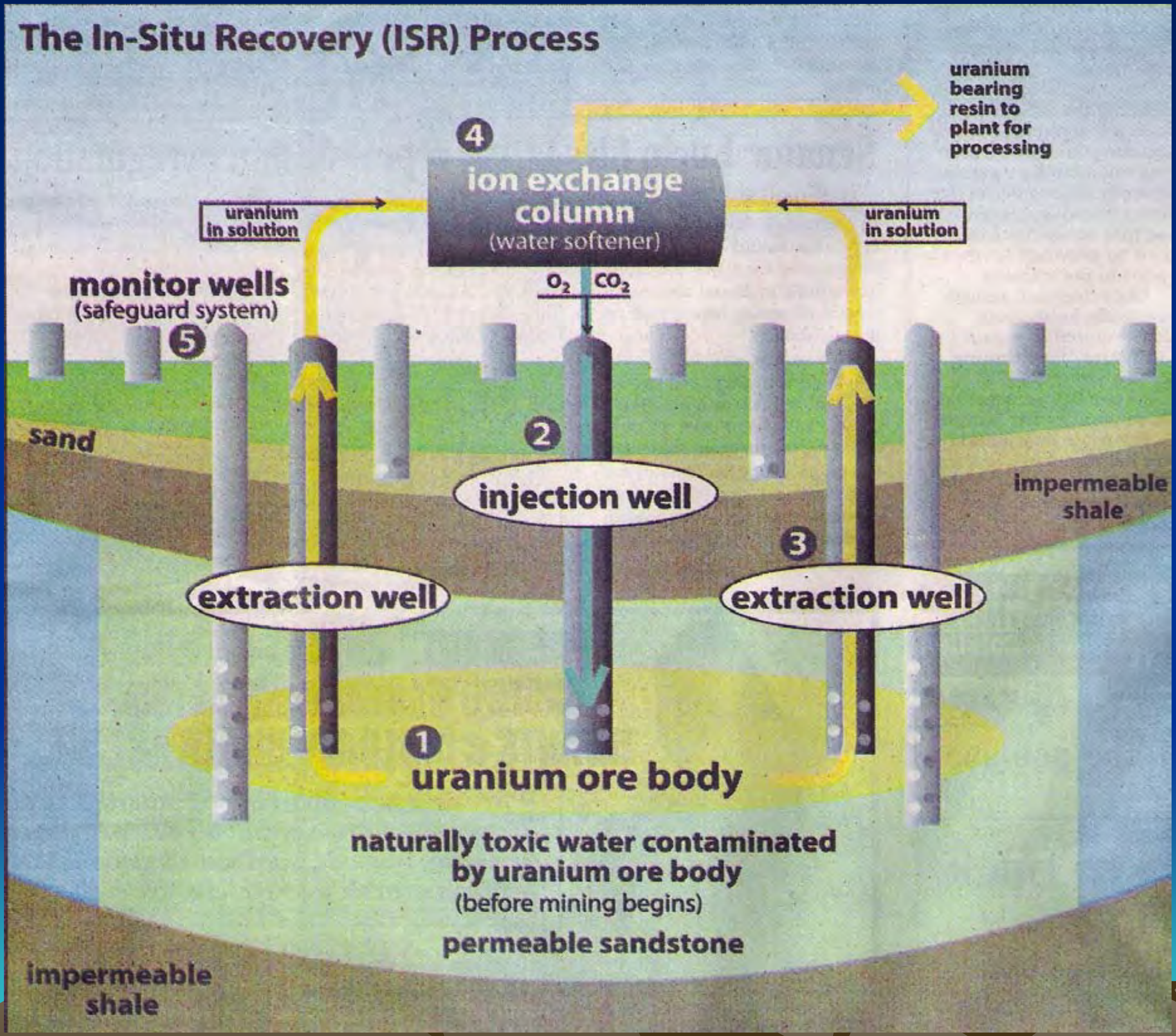
PR with Mining Companies

Require clear definitions of terms

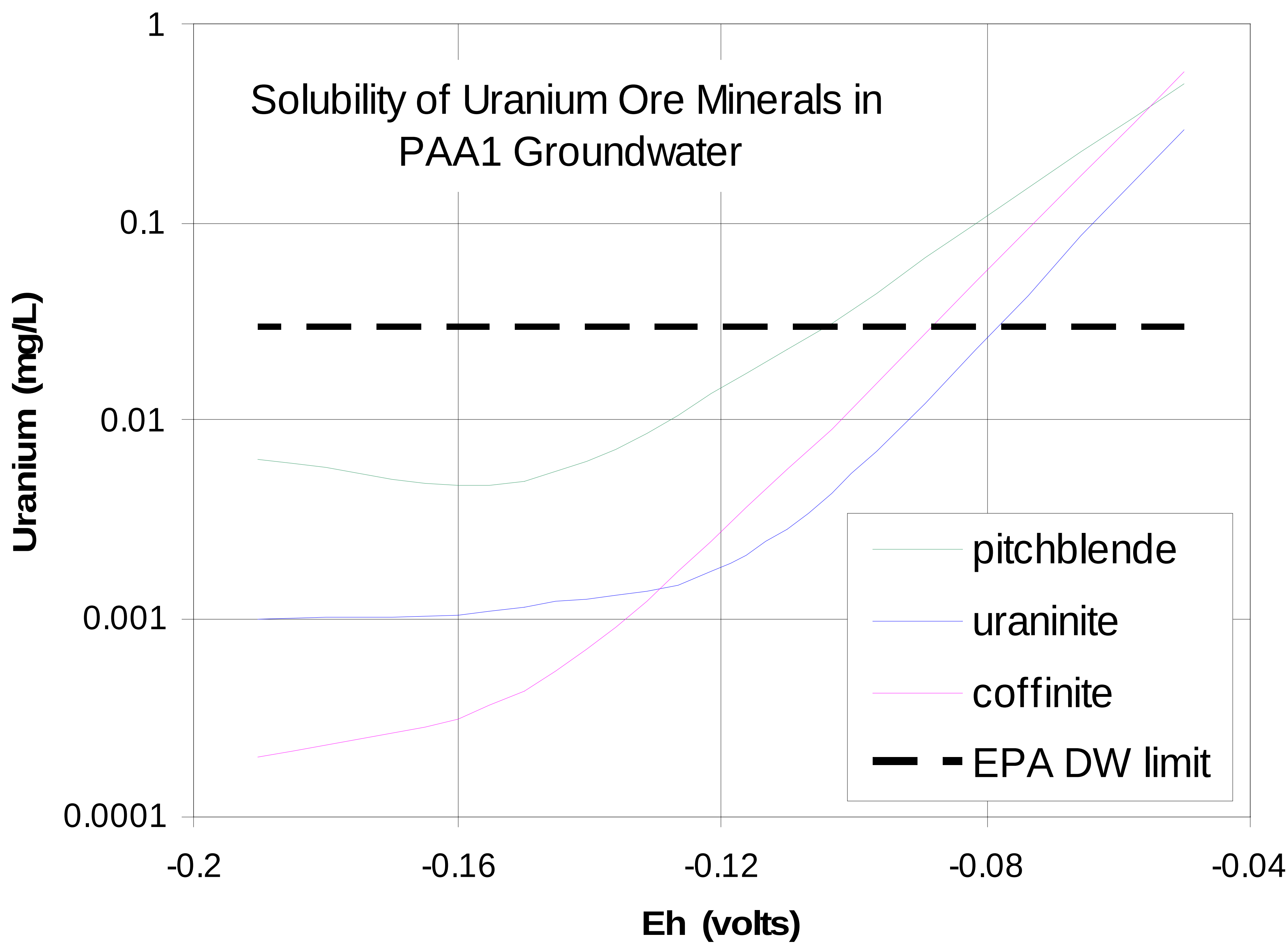
Baseline water quality – water quality established using statistically valid sampling locations, documented collection techniques, approved analytical laboratories and proper statistical methods for manipulating data.

Excursion limit – statistically valid limit that ensures protection of groundwater outside of the monitoring well ring

PR with Mining Companies



"However, the groundwater that is within and around the ore body is not safe to drink – it is naturally toxic because of the uranium ore and its byproducts."


Solubility of Uranium Ore Minerals in
PAA1 Groundwater
Uranium (mg/L)
1
0.1
0.01
0.001
0.0001
-0.2
-0.16
-0.12
-0.08
-0.04
Eh (volts)
pitchblende
uraninite
coffinite
EPA DW limit

PAA-1 Baseline Wells
Pre-mining Water Quality

Constituent /Property	I-6	I-7	I-8	I-9	I-10	I-11 (161)	I-12 (PBL-4)	I-13
Arsenic	**0.02**	0.002	0.001	0.002	0.001	0.001	**0.022**	0.005
Cadmium	**0.03**	**0.01**	**0.01**	**0.01**	**0.01**	<0.01	<0.01	<0.01
Fluoride	0.6	0.53	0.51	0.52	0.53	0.63	0.6	0.56
Mercury	**0.01**	<0.001	<0.001	<0.001	<0.001	0.0002*	<0.0002	<0.001
Nitrate (N)	<0.02	<0.1	<0.1	<0.04	0.35	<0.1	0.5	0.95
Selenium	**0.072**	0.001	<0.001	0.003	<0.001	<0.001	0.001	0.009*
na Radiation	NA	NA	NA	NA	NA	NA	NA	NA
Radium 226	**13**	**21.6**	**42.1**	**43.5**	**23.1**	0.66	0.84	**12.1**
Radon-222	NA	NA	NA	NA	NA	NA	NA	NA
Uranium	**0.68**	**0.077**	**0.180**	**0.13**	0.009	0.008	0.016	**0.156**
Chloride	229	234	229	229	219	352*	242	231
Iron	<0.02	0.03	0.05	0.05	0.02	0.11	<0.01	<0.01
Manganese	<0.001	0.02	0.01	<0.01	<0.01	<0.01	0.03	<0.01
pH	8.58*	8.85*	8.42	8.62*	8.48	7.82	8.71*	8.45
Molybdenum	0.014	0.09	0.05	0.08	<0.01	<0.1	0.2	<0.01
Sulfate	189	235	226	212	199	81	229	179
EC	1710	1740	1730	1670	972	1680	1750	1720
TDS	1030*	1030*	1030*	975*	972*	944*	972*	988*

Source:

Rice (2006)

Baseline Water Quality in Ore Zone Crownpoint, New Mexico

WELL	Ca	Mg	Na	K	CO3	HCO3	SO4	Cl	As	Mo	Se	U	Ra-226
							mg/L						pCi/L
CP-1	1.4	0.34	138	5.9	53	170	50	15	0.0005	0.0100	0.0005	0.006	0.9
CP-2	120	12	298	847	0	171	70	1325	0.0008	0.0100	0.0005	0.014	391
CP-3	5.5	1.7	161	41	17	229	133	42	0.0005	0.0060	0.0005	0.003	1.8
CP-4	0.7	0.03	132	9.2	140	9	45	6	0.0005	0.0050	0.0005	0.001	0.8
CP-5	2.9	0.2	102	1.7	6	222	35	2.5	0.0007	0.0050	0.0005	0.012	1.0
CP-6	1.6	0.1	109	2.4	23	202	35	3.5	0.0008	0.0050	0.0005	0.001	0.5
CP-7	0.9	0.037	118	5.6	62	149	33	3	0.0011	0.0075	0.0005	0.001	0.4
CP-8	2.5	0.2	112	2.2	24	205	38	3.5	0.0005	0.0088	0.0005	0.004	0.8

“It is horrifying that we have to fight our own government to protect the environment.”

Ansel Adams

“Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it is the only thing that ever has.”

Margaret Mead